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1986 NEW BRUNSWICK PESTICIDE SURVEY: A SURVEY OF THREE STREAMS DRAINING AGRICULTURAL AREAS

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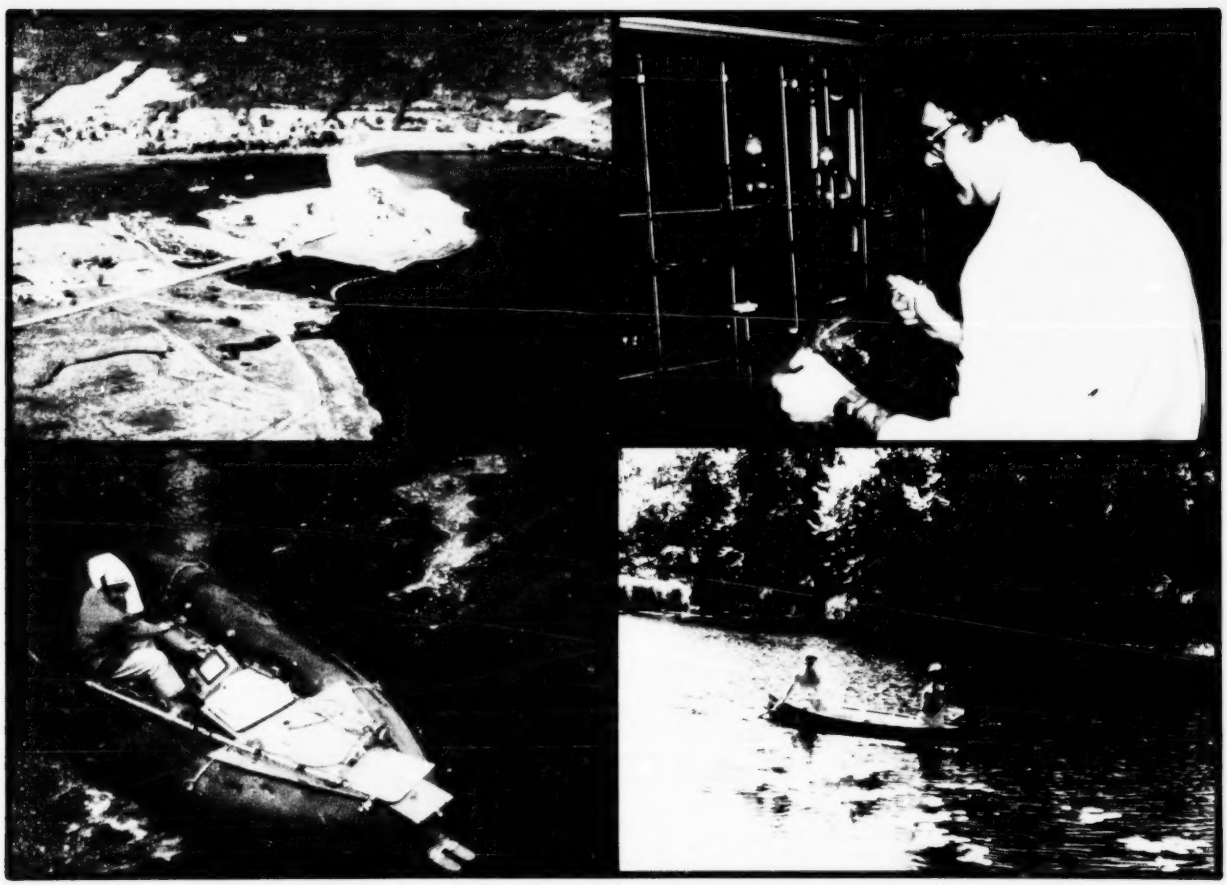

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INLAND WATERS DIRECTORATE
ATLANTIC REGION
WATER QUALITY BRANCH
MONCTON, NEW BRUNSWICK

1986 New Brunswick Pesticide Survey:

A Survey of Three Streams Draining Agricultural Areas

IW/L-AR-WQB-87-132

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ABSTRACT

The 1986 New Brunswick Pesticide survey was a basin and pesticide specific survey conducted in the middle reach of the Saint John River Valley. Water and bottom sediments were collected on three occasions from small basins that drain known agricultural areas into the Saint John River.

Analytical results indicated the presence of linuron on a single occasion in the Little Presque Isle Stream on July 4, 1986. No other in-use pesticides were observed in either water or bottom sediments. The presence of p,p'-DDT and its degradation products was observed in all bottom sediments reflecting the past widespread use of this organochlorine pesticide. One bottom sediment site displayed an anomolous reversal in the ratio of p,p'-DDE to p,p'-DDD while another site had reported DDT species levels an order of magnitude greater than the other study sites.

Major ion data were consistent with the geology of that part of the Saint John River basin. Nutrient concentrations also indicated anthropogenic inputs as reflected by the levels of total nitrogen and nitrate + nitrite.

SOMMAIRE

En 1986, une enquête sur des pesticides spécifiques a été effectuée dans la région médiane de la vallée de la rivière Saint-Jean, au Nouveau-Brunswick. En trois occasions, des échantillons d'eau et de sédiments de fond furent recueillis des petits bassins qui drainent des régions agricoles connues vers la rivière Saint-Jean.

Les résultats analytiques ont indiqué la présence de linuron dans le ruisseau Little Presque Isle, en une seule occasion, soit le 4 juillet 1986. Aucun autre pesticide employé présentement ne fut observé dans l'eau ou les sédiments de fond. La présence de p,p'-DDT ainsi que ses produits de dégradation fut observée dans tous les échantillons de sédiments de fond. Ceci reflète bien l'usage répondu passé de ce pesticide organochloré. À un site d'échantillonnage, le rapport des concentrations entre le p,p'-DDE et le p,p'-DDD, dans les sédiments de fond, fut anormalement inversé. Furent également observées, à un autre site, des concentrations d'un ordre de grandeur plus élevées que celles mesurées ailleurs durant cette enquête.

Les données concernant les ions principaux respectent le type de géologie qui domine cette région du bassin de la rivière Saint-Jean. Quant aux éléments nutritifs, tels que les nitrites-nitrates et l'azote total, ils indiquent des apports anthropiques.

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Introduction

Prior to 1983, Environment Canada's Water Quality Branch, Atlantic Region, conducted toxic chemical surveys that followed a general screening approach to the assessment of levels of environmental pollutants identified by the Department. Three reports were published based on this type of screening: Bailey et al (1983), Belliveau et al (1983) and Bailey (1984).

Since 1983, program direction has shifted from general screening surveys to studies that are more basin specific and reflect more accurately, in-use pesticide practices. Bailey (1985) surveyed the middle and upper reaches of the Saint John River Basin for selected pesticides and environmental contaminants. He reported the presence of the persistent pesticide DDT and its metabolites in water, bottom sediment and fish; α-BHC in all water samples and carbofuran at three sites in water. Clair, et al (1986) investigated water, bottom sediments and biota of the Annapolis Valley of Nova Scotia and found 2,4-D, alpha-BHC, and atrazine in water as well as DDT and its metabolites in bottom sediments. They also proposed that the fungicides diclone and mancozeb, used on fruit trees, were being transported atmospherically as they were observed in bottom sediments several kilometers from the application site. In 1985 Clair et al (1987) observed the triazine herbicide atrazine, DDT and traces of mirex at some sites on the Dunk River and South West Brook of Prince Edward Island. Bottom

sediments were observed to contain DDT, its metabolites, and at a few sites, traces of alpha-endosulphan. DDT and its metabolites were also observed in whole fish.

The major areas of pesticide usage in the Atlantic Region are the Saint John River Basin, the Cornwallis-Annapolis River Basins and most of Prince Edward Island. In 1985, 23,171 kg-AI (active ingredient) of insecticides, 87,092 kg-AI of herbicides and 270,915 kg-AI of fungicides were sold in New Brunswick to licenced vendors for agricultural usage (Shanks, 1985). These figures do not reflect direct deliveries to end users, but only commercial and restricted products. This illustrates that large amounts of pesticides are being purchased and applied within New Brunswick and implies significant usage along the Saint John River in particular.

The present pesticide survey is centered on three small basins that drain known agricultural areas and flow into the Saint John River between the towns of Hartland and Bath.

Methodology

Sampling Location

Three basins, figures 1 and 2, each draining a known agricultural area, were sampled: the Little Presque Isle Stream, the Lower Guisiguit Brook, and the Holmes Brook-Monquart Stream Basins. The Little Presque Isle and the Lower Quisiquit were each assigned one sampling station while the Holmes Brook basin consisted of a headwater station at Moose Mountain Lake, a station just above the confluence of Holmes Brook and the Monquart Stream, and a third at a pond just upstream of the confluence of the Monquart Stream and Saint John River. Station numbers and site locations are given in Table 1.

The sampling sites were chosen to facilitate the collection of water and bottom sediment samples. It was anticipated that ponds would provide an area of greater residence time in which any pesticides in the water column could reach equilibrium with the bottom sediment, and any suspended or runoff material might undergo deposition.

Parameters

The parameters analyzed were chosen in order to reflect historical pesticide practices (organochlorine pesticides) and present day usage patterns (organophosphorus insecticides,

carbamate insecticides and triazine herbicides). The selection of target pesticides was determined with the assistance of the New Brunswick Department of Municipal Affairs and Environment who, conducted a survey of farms in the area to ascertain which pesticides were in current use. Though not every farmer could be visited, those contacted indicated seventeen pesticides to be in use. Table 2 gives a summary of the farm survey by listing the trade/chemical names and the basins in which they were used. Disulfoton, aldicarb, MCPA, mancozeb, diquat, and metribuzin were found to be in use within all three basins. The amounts of these various pesticides sold in New Brunswick in 1985 to commercial distributors are given in Table 3.

Several of the in-use biocides could not be included in the analytical protocol either because they were beyond the analytical capability of the laboratory, or because standardized analytical methods did not exist. Nine pesticides that could be quantitated in water included: disulfoton, aldicarb, dinoseb, MCPA, metribuzin, chlorothalonil, carbofuran, phorate, and atrazine. Additional parameters were included in order to expand each pesticide group. Those additional parameters included: diazinon, malathion, imidan, aldicarb sulfoxide, aldicarb sulfone, 2,4-D, simazine, alachlor, EPTC, linuron, and carbaryl. Several persistent organochlorine pesticides were included because of past widespread usage.

Bottom sediment samples were also collected and analyzed using, where possible, the same parameter list as was used for the water samples. This was contingent upon the existence of an analytical method applicable to the instrumentation of the analytical laboratory. A list of the pesticides and environmental contaminants on the 1986 analysis protocol for water and sediment is given in Table 4, including their respective NAQUADAT (National Water Quality Data Bank) parameter codes and detection limits.

Major ions, metals and physical parameters, Table 5, were also analyzed in water to describe the background water chemistry, and ascertain anthropogenic inputs.

Sample Collection

Field collection of water and bottom sediment was carried out on three occasions during the study period: late April before the commencement of pesticide applications, and early July and August when pesticide usage would be greatest. Water and sediment grab samples for pesticide, metal and major ion analyses were collected according to Water Quality Branch recommended methods (Environment Canada, 1983). Preservation methods for samples are detailed in Table 6. Sediment grab samples were collected using a 23 cm X 23 cm stainless steel Ekman dredge. At each site at least three samples were taken, with the top 1.5 cm layer being pooled, thoroughly hand mixed,

sub-divided into 3 pre-cleaned aluminum containers, and frozen immediately. The samples were thawed just prior to analysis.

Analytical Methodology

All water analyses were performed using the methods and procedures described in the Water Quality Branch Methods Manual (Environment Canada, 1979), as well as methods obtained from external sources. The NAQUADAT Dictionary of Parameter Codes (Environment Canada, 1985) contains brief descriptions of analytical methodologies. Parameter Codes of the 89... series are either awaiting NAQUADAT approval or represent methods that were modified to reflect in-house, Branch analytical instrumentation. Bailey (1985) summarized the analytical procedures that were applied to bottom sediments for the quantitation of carbamate insecticides, organophosphate insecticides, and triazine herbicides.

Carbamate insecticides in water were determined using high performance liquid chromatography with post column reaction and fluorescence detection. A concentrator column was installed in the sampler loop such that this column could be back flushed onto the analytical column. Separation was followed by post column hydrolysis to yield methylamine, and the formation of a fluorophore with 0-phthaldehyde and 2-mercaptoethanol prior to fluorescence detection (Chaput, 1986). This methodology allowed

a detection limit of 0.01 μg/L for aldicarb and its two oxidation products, aldicarb sulfoxide, and aldicarb sulfone.

In all cases where positive observations were noted, samples were re-analyzed on a chromatography column of different polarity. Organochlorine pesticides and polychlorinated biphenyls were analyzed through simultaneous injection onto two gas chromatography capillary columns of different polarity. Confirmation was carried out by using relative retention times and relative peak response.

Quality Control

The quality control aspect of the study consisted of two components; triplication and spiking. During each sampling trip water samples were collected in triplicate at a site randomly chosen. Also on a random basis a water sample was spiked with a known amount of various pesticides. In addition to spiking samples, distilled water was transported from the laboratory to be used for the preparation of blanks and spikes. The use of blanks, spiked blanks and spiked samples was undertaken to identify and minimize procedure variables. After spiking, the samples were allowed to equilibrate for no more than 5 hours and were preserved. Also, on a random basis, bottom sediments were sub-sampled and a 20 g (wet weight) aliquot was spiked with a known amount of pesticide. These spikes were then frozen until analysis.

Spiking solutions were prepared in advance by the staff of the trace organic laboratory and reflected the various pesticide groups on the 1986 analytical protocol. Spiking solutions were kept refrigerated and only allowed to warm to ambient temperature just prior to usage.

In addition to program specific quality control, the Analytical Services Division routinely participates in various quality control and quality assurance studies of inter-laboratory and intra-laboratory nature. These studies are used to assess laboratory performance in the analysis of major ions, metals, nutrients and pesticides (Brun, 1986, 1987).

All quality control samples were handled by the field collection, and laboratory staff as regular samples.

Results and Discussion

Background Chemistry

Water

The study area lies within the reach of the Saint John River from the confluence of the Tobique River to Woodstock. This area is underlain by calcareous and argillaceous sedimentary rocks and slates, sandstones and conglomerates (Gillis *et al*, 1986). The levels of observed calcium, magnesium, and alkalinity in water, Table 7, reflect this underlying geology and illustrate that the waters are well buffered.

The higher color values observed on the Little Presque Isle Stream on August 5 are most likely associated with the corresponding higher organic carbon levels observed on the same date. Recorded field observations indicate that heavy aquatic growth was observed at Moose Mountain lake and at Holmes Brook throughout the study period. The observed levels of nitrate + nitrite suggest that there were sufficient nitrogen nutrients. The ratio of total nitrogen to total phosphorus in all cases exceeds 10:1 which indicates that at the time of sampling phosphorus was the limiting nutrient (Wetzel 1975). The ambient levels of nitrate + nitrite and total nitrogen are most likely enhanced by anthropogenic inputs.

Table 8 contains the heavy metal observations from the study area. No copper, lead, zinc, or cadmium was detected in water at any of the sites. Iron, manganese and aluminum were observed but were all within proposed limits for protection of the aquatic environment and under the levels for typical surface waters (McNeely et al, 1979).

Pesticide Results

Water

Though samples were collected in the spring during runoff and during the growing season when in-use practices would infer the presence of pesticides, virtually no pesticides were observed in the water samples collected (Table 9). Trace levels of alpha-BHC were observed in July at Moose Mountain Lake and Holmes Brook, and in August at Little Presque Isle Stream and Moose Mountain Lake. Alpha-BHC is ubiquitous and has been observed in rainfall and snowpack in the region (Brun 1983, 1984, 1985). Lindane (gamma-BHC), the insecticidal isomer of hexachlorocyclohexane, was not detected.

One single value for linuron was observed on July 4, 1986 at the Little Presque Isle Stream at a level of 0.031 μg/L, which is four times the detection limit. This value was confirmed on a second capillary column of different polarity. There are no other anomalous values for that date to indicate

that there was field contamination by the spiking solution. The use of linuron was not noted in the survey conducted by the Department of Environment and Municipal Affairs, but, not all farms within the basin were surveyed. The quantitation standard was of mixed composition implying that laboratory contamination was also unlikely. The mean recovery from the Quality Assurance program for linuron was 68.5 percent thus supporting the validity of the observed value.

Sediments

The historical use of DDT is reflected by data in Table 10, which show that p,p'-DDT, o,p-DDT, p,p'-DDD and p,p'-DDE were observed in bottom sediments. Due to an operational oversight the spring set of bottom sediment samples were not initialized on the laboratory data management system resulting in their absence from Table 10. The absence of the spring sediment samples is felt to be inconsequential, in this case only, due to the lack of positive observations for any in-use pesticides. It is recognized that a pre-application sampling is critical in establishing background levels of a target compound. Clair et al (1986, 1987) observed DDT and degredation products in bottom sediments from the Annapolis Valley and Prince Edward Island respectively. Bailey (1985) reported similar observations for nine impoundments on the Saint John River with the three impoundments closest to the Holmes Brook Study area (Beechwood,, Pokiok, and Mactaquac) having mean total concentrations of DDT

substrates in triplicate samples at levels of 0.042 mg/kg, 0.036 mg/kg, and 0.057 mg/kg respectively.

The levels observed in the 1986 study basins are higher than those observed in the Saint John River headponds. This can be ascribed to the fact that the small basins studied directly drain agricultural areas where DDT might have been used in the past. The past use of DDT (until the late 60's) in the annual New Brunswick Spruce Budworm Abatement Program (Pearce et al, 1979) would also be a contributing factor to present day bottom sediment observations.

Of interest is the difference in the ratio of p,p'-DDD to p,p'-DDE observed at Moose Mountain Lake. Table 11 contains the DDT metabolite information as extracted for each site from Table 10. Columns 2 to 5 list the observations in mg/kg for p,p'-DDT, o,p-DDT, p,p'-DDD and p,p'-DDE respectively. Column 6 lists the sum of all DDT substrates, Column 7 the ratio of DDE to DDD, Columns 8 and 9 the sums of the parent (DDT) and metabolite degradation products (DDE + DDD) and Column 10 the ratio of parent to metabolic species. Of note is that at the headwater site of Moose Mountain Lake almost no parent DDT species were observed while DDD and DDE were reported. This implies that there had been significant degradation because the total of DDT substrates (Column 6) are similar to observations from the Monquart, Lower Guisiquit and Little Presque Isle. However the ratio of DDE to DDD is reversed at Moose Mountain Lake. The

ratios reported for the other sites are similar to those obtained from a 1985 pesticide survey on Prince Edward Island. Of 368 bottom sediments collected in the region from freshwater sources only 20 have displayed a reversed ratio: the six samples in this study, 6 from a pond at Klahanie campground in Aylesford, Nova Scotia and 8 from Silver Lake in Nova Scotia. Chau and Afghan (1982) reference several authors who indicate that under anoxic conditions in sediments, the formation of p,p'-DDD is favored while under aerobic conditions p,p'-DDE is favored. Sharom et al. (1980) have indicated that microbial breakdown rather than chemical degradation was the principal pathway of DDT breakdown in water. What is being observed could indicate a site specific effect that favors the formation of DDD rather than DDE.

Also of interest in Table 11 are the higher levels of p,p'-DDT and o,p-DDT observed at Holmes Brook. These levels are an order of magnitude higher than those at the other sites and in the case of p,p'-DDT are the highest reported in freshwater bottom sediments in the region (368 samples). The ratio of the two metabolites at Holmes Brook is similar again to those of P.E.I. and other sediments in the region. Of significance though is that the ratio of parent compounds to metabolites is highest at Holmes Brook. This would lead to the conclusion that at some point Holmes Brook has received direct input of DDT from agricultural usage. This could have been as a result of surface runoff, spray drift, improper container flushing or disposal,

leaks from spray equipment or disposal of old formulations. The levels reported in the remaining sediments likely represent background associated with the use of DDT in the budworm spray programs of the late 1950's. Regardless of the source it would appear that degradation has not advanced as far as it has at other sites in the study area.

With the exception of the DDT metabolites, no other persistent organochlorine insecticides were observed in the bottom sediments from the study areas. Dieldrin would not be quantitated as it degrades in the cleanup procedure applied to the sediment extracts. No positive observations were recorded for any of the organophosphorus insecticides, phenoxyacid herbicides, triazine herbicides or carbofuran, the only carbamate insecticide quantitated. Aldicarb and its metabolites could not be quantitated in sediments due to the absence of an analytical method applicable to the post-column quantitation technique. It should be noted that for sediments the detection limits varied in some cases between the triplicate samples for a particular site. The detection limits reflect trace minimum detectable amounts for a sediment sample, as the limit is determined by extrapolating the minimum detectable amount of stock standard solution to the amount of dry weight sediment. This method of determining detection limits more accurately reflects instrument operational response, matrix analysed, and the amount of analyte.

Glyphosate and dinoseb were not quantitated due to the lack of an applicable method. The analyses of EPTC, linuron and chlorothalonil were affected by matrix effects and co-extractives which interfered with their quantitation on the gas chromatograph. The acid clean-up used on sediment extracts for organochlorine quantitation could not be applied to the organophosphorus (OP) extracts for fear of destroying all the OP insecticides.

Quality Control Results

Water

The spiking aspect of the 1986 New Brunswick Pesticide Survey Quality Control Program consisted of three parts: the field preservation of distilled water blanks, the spiking and preservation of distilled water and the spiking and preservation of collected water samples. Table 12 lists the percent recoveries for the various pesticides that were in the spiking solutions. The last four digits of the station number indicate whether the field spike was spiked distilled water (eg FSDW) or a spiked sample (eg FS32).

The spiking solution that was used in April was a temporary solution that was prepared on short notice by the analytical laboratory staff, and contained only alachlor, dinoseb, EPTC, linuron, and chlorothalonil. The July and August quality controls utilized a spiking solution with a more comprehensive parameter selection. The percent recoveries in the April quality controls ranged from 31.5% for EPTC to 121% for alachlor, while the July and August spikes had observed recoveries ranging from 45% for simazine to 105% for p,p'-methoxychlor.

Diazinon and disyston had varying recoveries which were attributed to the relatively similar retention times observed

during quantitation. The problem of co-elution was most dramatic in the distilled water spikes of July 3rd and August 5th. Another anomaly occurred in the distilled water spike of August 5th where it was observed that there was no phorate, yet, the recovery in the other spikes was at least 71%. The absence of phorate was confirmed utilizing two capillary columns of different polarity. There have been observed problems with recoveries of organophosphorus pesticides in other quality control programs (Clair et al 1987, Benoit et al 1986). There were somewhat low recoveries for the organochlorines beta-endosulphan and alpha-chlordane with a mean recovery of 56% and 46% being observed respectively. There was a very good mean recovery for metribuzin of 94% but a significantly lower recovery of 45% for simizine, indicating that there could have been some degradation of simizine or loss within the analytical technique.

In general, the distilled water spikes had slightly higher recoveries than the sample spikes on the same date, although there were some exceptions (phorate, metribuzin and dinoseb). The higher recoveries of the distilled water spikes is attributed to the minimizing of matrix and microbial effects that would be encountered in the spiked samples. Some of the spikes also indicated recoveries greater than 110 percent yet the actual samples were less than detection limit. This is illustrated by malathion where both distilled water spikes

contained 157 and 115 percent recoveries. The observed high recovery may be due to concentration of the stored malathion stock solution.

Sediments

As with the bottom sediment samples from the spring sample collection, the quality control spikes were not initialized on the data management system leaving four sediment spikes. Two sediments were spiked with persistent organochlorine pesticides and the remaining 2 with the triazine herbicides. Spike recoveries for the persistent organochlorines ranged from 52% to 100% while the percent recoveries for the triazines were mixed, with atrazine recoveries at 87% and 84%, simazine at 43% and 36% and metribuzin at 58% and 36%. The low recoveries for simazine and metribuzin may be due to either matrix effects, or breakdown and loss during the analytical procedure.

CONCLUSIONS

The 1986 New Brunswick Pesticide Survey of the Little Presque Isle Stream, the Lower Guisiquit Brook and the Holmes Brook-Monquart Stream basins resulted in only a single observation for a pesticide in water. Linuron was observed on July 4, 1986 at the Little Presque Isle Stream site. Alpha-BHC, a ubiquitous isomer of hexachlorocyclohexane, was also observed at low levels in some samples from the study areas. Bottom sediments were found to contain only DDT and its degradation products. The presence of these contaminants is due to the past widespread use of DDT. No in-use pesticides were found in either medium except for the one instance of linuron.

Though a basin inventory of potential pesticides yielded nine agents that could be quantitated, none were observed. This indicates that the target pesticides are either not reaching the water course due to various chemical and physical processes, or, are present but at levels too low to detect. Also, due to the uncertainty of applications times, it is conceivable that the in use pesticides may have been present at some time but not on the days that were sampled. As herbicides are typically applied early in the growing season, it is likely that the samplings in July and August were too late to observe any herbicide in water. Various authors: Miles et al. (1979), Chau and Afghan (1982), and Read (1986) have reported various mechanisms of microbial, chemical and photochemical degradation for organophosphorus and

carbamate pesticides. Clair et al. (1987) encountered a similar lack of detectable levels of pesticides in a study on Prince Edward Island and referenced degradation possibilities.

No follow-up survey was carried out to verify what pesticides had actually been applied during the 1986 growing season. The type and magnitude of any infestation would have dictated what biocide, if any, had been used. As the cost of pesticides can be high, some farmers may have opted at the last moment to either not apply a pesticide or may have changed to another less costly product unbeknownst to the Water Quality Branch. Any last minute change in pesticide application would not be reflected in the analysis protocol established by the Branch.

The initial concept and approach of the 1986 New Brunswick Pesticide Survey appears to have been sound in that: a basin inventory of potential target pesticides was carried out; the basin with the greatest pesticide inventory was most heavily sampled with a headwater site and two down stream ponds that are deposition zones with longer residence times; and a quality control program was used throughout the field and laboratory collection and handling of the samples. The presence of degradation products was to a certain extent addressed by the analysis of the oxidation products of aldicarb.

However, certain aspects of the study could have been improved. The basin with the greatest pesticide inventory could have been sampled more frequently and at more sites. Sampling was carried out during fine weather when the inputs from surface runoff would be non-existent, rather than incorporating post rain event collections when surface runoff or suspended material might be expected to contain pesticide residues. Sampling could also have been carried out at times that better matched application dates of biocides in a particular basin.

Nevertheless, observations obtained during the 1986 New Brunswick Pesticide Survey represent valid data within the spatial and temporal operational limits.

RECOMMENDATIONS

In light of the significant amounts of pesticides used in the agricultural industry in the Atlantic Provinces and the many active ingredients under review by various government agencies, the authors recommend that the Water Quality Branch continue to investigate the presence of in-use pesticides in the aquatic environment. All scientifically documented observations add to the data base of a target compound. The use of small basins and specific target chemicals which facilitates the collection and quantitation of samples, should be continued in future investigations. Basin studies should cover various weather conditions and attempt to quantitate target compounds in as many media as possible. Areas of probable suspended sediment loading should be identified and where possible the aqueous and suspended phases collected and analyzed as separate phases. The use of larger volume water samples combined with suspended sediment analyses could prove or disprove any dilution effects.

Another survey of Moose Mountain Lake and Holmes Brook at Holmesville would be useful for verification of the reversed metabolite ratios observed at Moose Mountain Lake and high levels of DDT contamination at Holmes Brook.

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FIGURE 1.

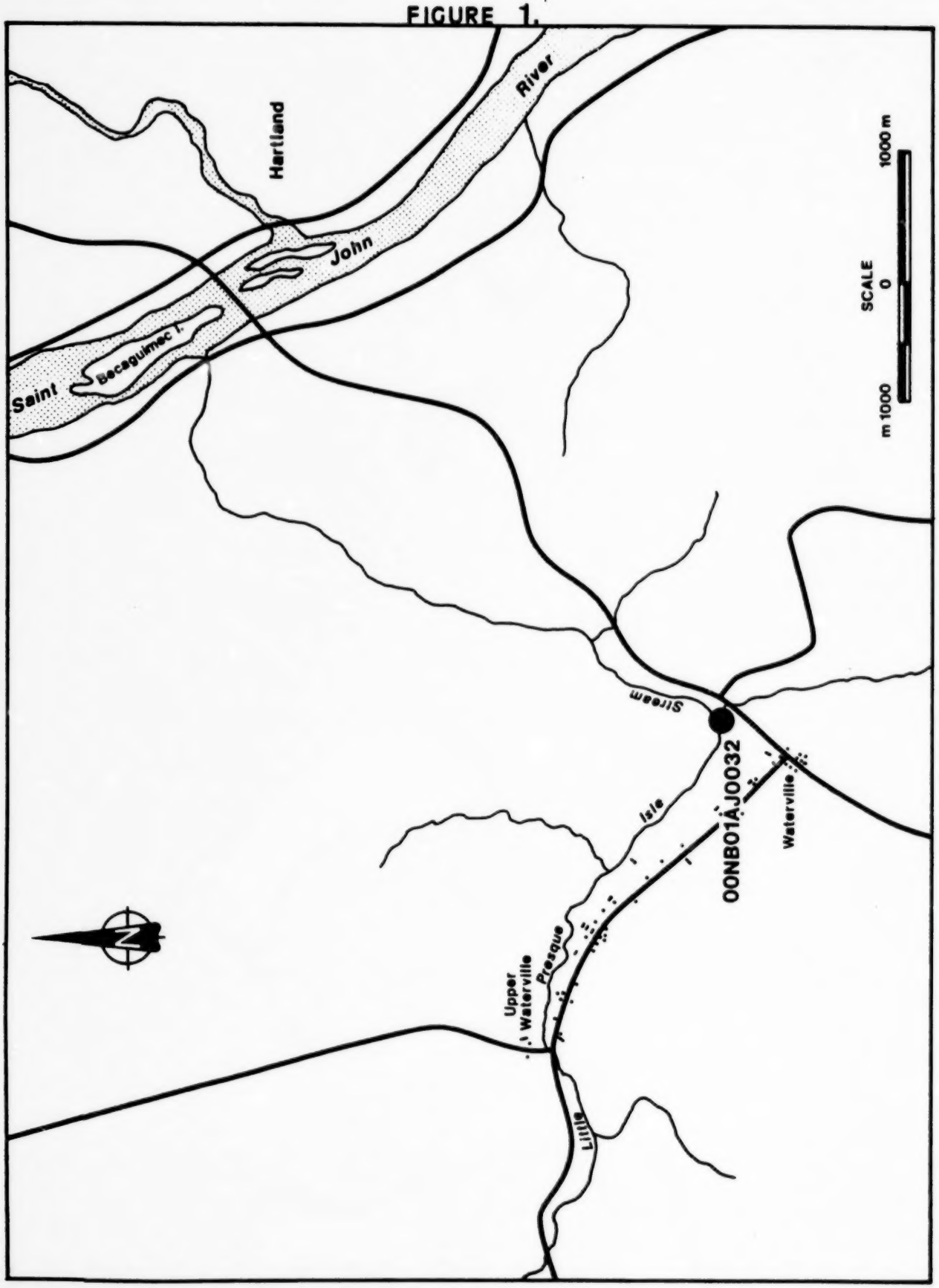
Hartland
River
John
Saint
Becaguimec I.
SCALE
0
1000 m
m 1000
Stream
Isle
Waterville
00NB01AJ0032
Upper
Waterville
Presque
Little
N

FIGURE 2.

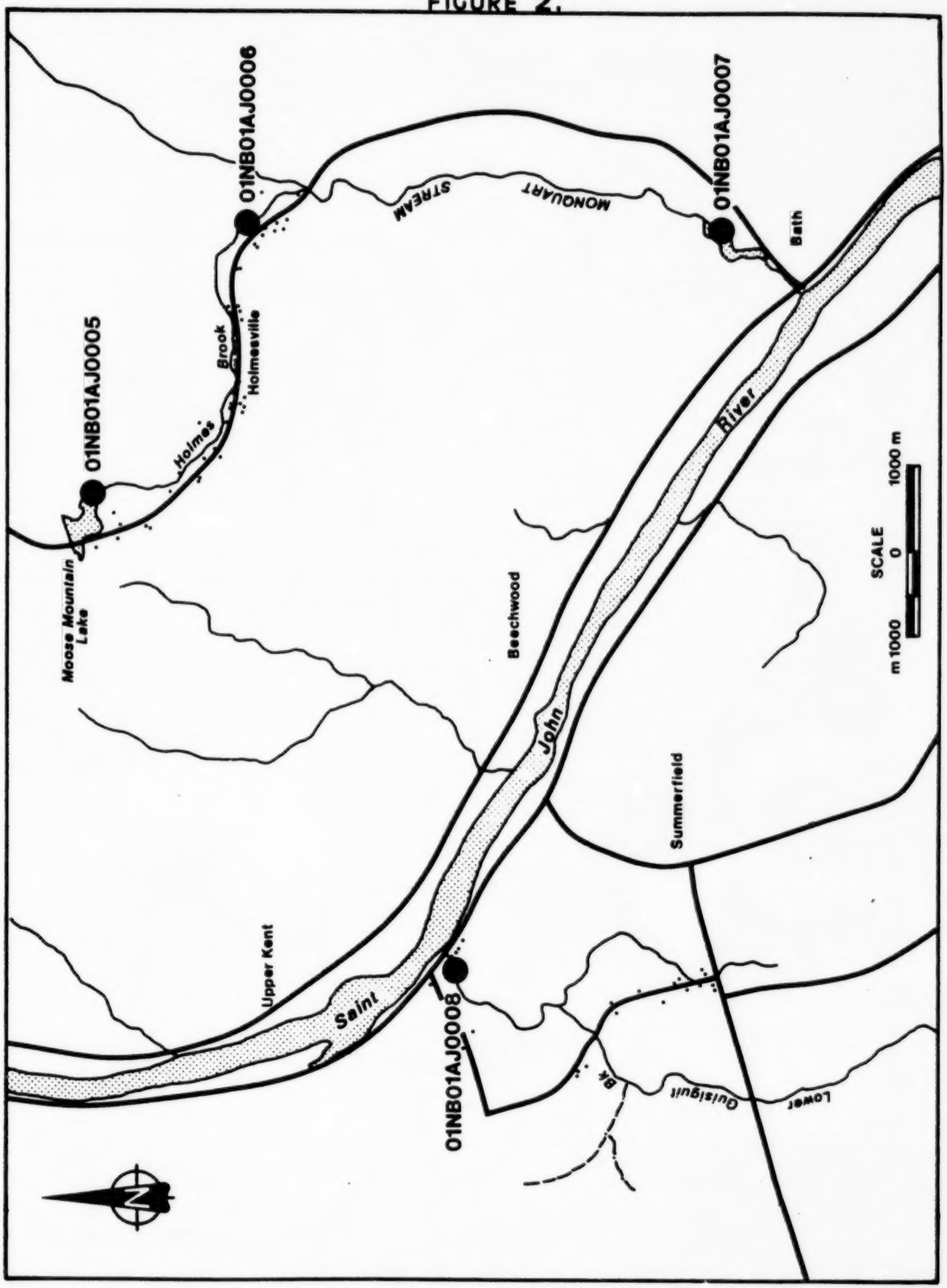
01NB01AJ0006
01NB01AJ0007
01NB01AJ0005
01NB01AJ0008
Monquart Stream
Holmes Brook
Holmesville
Bath
Moose Mountain Lake
Beechwood
Saint John River
Summerfield
Upper Kent
Lower Gulsigwit Bk
SCALE
m 1000 0 1000 m
N

TABLE 1

Station Numbers and Site Descriptions for 1986 Sampling Locations

STATION NUMBER		SITE DESCRIPTION
H_2O	01NB01AJ0005	Outlet Moose Mountain Lake
Sed.	51NB01AJ0005	Inlet Moose Mountain Lake
H_2O	01NB01AJ0006	Unnamed Pond on Holmes Brook at
Sed.	51NB01AJ0006	Holmesville
H_2O	01NB01AJ0007	Unnamed Pond on Monquart Stream
Sed.	51NB01AJ0007	at Bath
H_2O	01NB01AJ0008	Unnamed Pond on Lower Guisiquit
Sed.	51NB01AJ0008	at Trans Canada Highway
H_2O	00NB01AJ0032	Little Presque Isle Stream at
Sed.	51NB01AJ0032	Old Dam Site at Waterville

TABLE 2

In-Use Pesticides in 1986 Study Area from
New Brunswick Department of Environment and Municipal Affairs

PESTICIDE TRADE AND/OR COMMON NAME	LITTLE PRESQUE ISLE STREAM AREA	GUISIQUIT BROOK AREA	HOLMES BROOK AREA
Disyston-Disulfoton	*	*	*
Temik-Aldicarb	*	*	*
Premerge-Dinoseb	*		*
MCPA	*	*	*
Dithane-Mancozeb	*	*	*
Reglone-Diquat	*	*	*
Sencore-Metribuzin	*	*	*
Bravo-Chlorothalonil		*	
Furadan-Carbofuran		*	*
Belmark-Fenvalerate		*	*
Thimet-Phorate		*	
Ridomil-Metalaxyl		*	*
Decis-Deltamethrin		*	*
Gramoxone-Paraquat			*
Polyram			*
Poast-Sethoxydim			*
Atrazine			*

TABLE 3

Insecticides, Herbicides and Fungicides Sold in New Brunswick in 1985 (Shanks 1985)

TRADE AND/OR COMMON NAME	ACTIVE INGREDIENTS	AMOUNT (L)	AMOUNT (kg)	AMOUNT ACTIVE INGREDIENT(kg)
Disyston-Disulfoton	DIS	0	57416	8612
Temik-Aldicarb	ADC	0	1755	176
Premerge-Dinoseb	DNB, DNB+NAP	139561	0	46662
MCPA	MAB, MAE, MAS, MAS+MBS	13663	0	6426
Dithane-Mancozeb	MCZ	0	272380	193875
Reglone-Diquat	DIQ	50740	0	10148
Sencore-Metribuzin	BAX	124	2176	1681
Bravo-Chlorothalonil	TET	15260	0	6147
Furadan-Carbofuran	CAF	2122	2278	1235
Belmark-Fenvalerate	FEV	662	3.3	199
Thimet-Phorate	PHR	0	11950	1792
*Ridomil-Metalaxyl	MTA+MCZ	238	32388	23376
Decis-Deltamethrin	DBR	1989	0	44
Gramoxone-Paraquat	PAQ	14174	0	2835
Polyram				
Poast-Sethoxydim	SOD	743	0	135
**Atrazine	ATR, ATR+BDX, ATR+MTL	2253	697	1736

* Metalaxyl = MCZ+MTA represents total A.I.
** Atrazine = totals of three formulations

TABLE 4

Pesticides and Environmental Contaminants included in the 1986 Analytical Protocol

DESCRIPTION	PARAMETER CODE AND DETECTION LIMIT	
	WATER µg/L	SEDIMENT mg/kg
P,P-DDT	18000-L.001	18009-L.001
O,P-DDT	18005-L.001	18008-L.001
P,P'-DDD	18010-L.001	18012-L.001
P,P-DDE	18020-L.001	18026-L.001
P,P-Methoxychlor	18030-L.01	18034-L.05
Heptachlor	18040-L.001	18043-L.001
Heptachlor Epoxide	18045-L.001	18048-L.001
Alpha Endosulphan	18050-L.01	18054-L.01
Beta Endosulphan	18055-L.01	18058-L.01
Alpha Chlordane	18060-L.005	18063-L.005
Gamma Chlordane	18065-L.005	18068-L.005
Gamma BHC	18070-L.001	18079-L.001
Alpha BHC	18075-L.001	18074-L.001
Mirex	18125-L.001	18128-L.001
Aldrin	18130-L.001	18133-L.001
Endrin	18140-L.01	18143-L.01
Dieldrin	18150-L.001	18153-L.001*
Arochlor Total	18164-L.005	18177-L.005
Diazinon	18270-L.001	89093 **
Disyston	18215-L.001	89095 **
Malathion	18250-L.001	89052-L.01
Phorate	18300-L.001	89048 **
Imidan	18205-L.004	89058
Carbofuran	89271-L.01	89270-L.01
Aldicarb Sulfone	89292-L.01	
Aldicarb Sulfoxide	89291-L.01	
Aldicarb	84290-L.01	
2,4-D	18500-L.004	18501-L.004
MCPA	89410-L.10	89405-L.10
Atrazine	89802-L.004	89803 **
Metribuzin	89820-L.03	89821 **
Simizine	89818-L.02	89819 **
Alachlor	89973-L.015	89974 **
EPTC	89979-L.002	
Linuron	89982-L.008	
Chlorothalonil	89985-L.008	
Carbaryl	89305-L.01	
Dinoseb	89824-L.02	

* Dieldrin destroyed by acid clean-up on sediments
** Indicates that Detection Limit varied based upon dry weight and minimum quantifiable limits

TABLE 5

Physical, Major Ion, and Metal Parameters Descriptions, Parameters Code and Reporting Units

DESCRIPTION	PARAMETER CODE	UNITS
Color Apparent	02011L	
Turbidity	02073L	J.T.U.
Specific Conductance	02041L	USIE/cm
pH	10301L	pH units
Residue - Non-filterable	10401L	mg/L
Calcium	20110L	mg/L
Magnesium	12107L	mg/L
Potassium	19103L	mg/L
Sodium	11103L	mg/L
Silica	14102L	mg/L
Alkalinity	10101L	mg/L
Chloride	17205L	mg/L
Sulphate	16304L	mg/L
Dissolved Organic Carbon	06107L	mg/L
Nitrate + Nitrite, Nitrogen	07110L	mg/L
Nitrogen (Total)	07601L	mg/L
Phosphorus Total	15413P	mg/L
Copper Extractable	29305P	mg/L
Lead	82302P	mg/L
Zinc	30304P	mg/L
Iron	26304P	mg/L
Manganese	25304P	mg/L
Aluminum	13305P	mg/L
Cadmium	48302P	mg/L

TABLE 6

Methods of Sample Preservation for Toxic Substances

PARAMETERS	SAMPLE PRESERVATION TECHNIQUE
Sediments	Samples placed in prewashed aluminum containers and frozen until analysis.
Water:	
Metals	1 mL of concentrated nitric acid (ultrex) per 500 mL.
Organochlorine Pest. Organophosphate Pest. Polychlorinated Biphenyls	100 mL of pesticide quality hexane per 4 liters, and store at 4°C.
Carbamate Pest. Phenoxy Herbicides	Adjust to pH 3 with 50% sulphuric acid, add 40 grams sodium sulphate and store at 4°C.
Triazine Herbicides	Adjust to pH 8 with 0.1 M sodium hydroxide, add 200 mL of methylene chloride per 4 liters and store at 4°C.

TABLE 7: MAJOR ION AND PHYSICAL PARAMETER OBSERVATIONS,
1986 N.B. PESTICIDE SURVEY. REPORTED IN MG/L, UNLESS OTHERWISE NOTED

	STN	SAMPLE	SDATE	COLOR APPARENT	CALCIUM DISS.	ALKALINITY TOTAL	TURBIDITY JTU.	MAGNESIUM DISS.	POTASSIUM TOTAL
1 PRESQUE	00NB01AJ0032	600372	30-APR-86	15	27.0	64.4	0.3	2.1	0.58
2 ISLE	00NB01AJ0032	601203	04-JUL-86	5	45.0	112.6	2.0	3.6	0.60
3	00NB01AJ0032	601470	05-AUG-86	45	35.0	83.0	1.3	2.9	0.32
4	00NB01AJ0032	601471	05-AUG-86	45	35.0	80.8	1.3	2.9	0.29
5	00NB01AJ0032	601469	05-AUG-86	45	35.0	80.7	1.2	2.9	0.30
6 MOOSE MTN.	01NB01AJ0005	600369	29-APR-86	L5.	26.0	66.2	0.5	2.6	0.65
7 LAKE	01NB01AJ0005	601201	03-JUL-86	5	17.0	51.9	1.2	4.0	0.48
8	01NB01AJ0005	601474	06-AUG-86	10	23.0	66.0	1.0	3.8	0.39
9 HOLMES	01NB01AJ0006	600366	29-APR-86	L5.	26.0	59.7	1.0	2.9	0.48
10 BROOK	01NB01AJ0006	600367	29-APR-86	L5.	26.0	60.3	1.0	2.9	0.48
11	01NB01AJ0006	601198	03-JUL-86	5	38.0	95.3	1.1	3.6	0.44
12	01NB01AJ0006	601199	03-JUL-86	5	38.0	94.7	1.5	4.5	0.41
13	01NB01AJ0006	601200	03-JUL-86	5	38.0	94.1	1.6	4.5	0.42
14	01NB01AJ0006	601475	06-AUG-86	15	39.0	98.2	1.8	4.5	0.32
15 MONQUART	01NB01AJ0007	600370	30-APR-86	L5.	12.0	27.4	0.4	1.5	0.27
16 STREAM	01NB01AJ0007	601202	03-JUL-86	5	23.0	57.7	0.9	2.8	0.36
17	01NB01AJ0007	601473	06-AUG-86	5	24.0	62.5	0.5	2.6	0.30
18 LOWER	01NB01AJ0008	600371	30-APR-86	L5.	45.4	108.7	0.9	3.4	0.73
19 GUISIQUIT	01NB01AJ0008	601197	02-JUL-86	10	37.0	91.1	1.1	3.5	0.56
20	01NB01AJ0008	601472	06-AUG-86	10	42.0	104.3	0.8	3.7	0.55

	SODIUM DISS.	PH PH UNITS	CHLORIDE DISS.	SULPHATE DISS.	SILICA REACTIVE	CONDUCTANCE USIE/CM	ORG.CARBON DISS	NO3+NO2 DISS.	NITROGEN TOTAL
1 PRESQUE	1.3	7.7	3.0	6.5	1.33	150	6.8	0.28	0.39
2 ISLE	2.2	7.8	4.3	7.6	1.65	249	5.4	0.33	0.57
3	1.6	7.8	3.1	5.6	3.66	189	10.0	0.18	0.32
4	1.6	7.7	3.1	5.4	3.81	189	9.9	0.18	0.32
5	1.6	7.7	3.1	5.4	3.70	189	10.0	0.17	0.30
6 MOOSE MTN.	1.7	7.8	4.1	4.0	0.24	154	4.3	0.19	0.30
7 LAKE	2.3	8.4	5.2	2.3	2.16	127	6.1	L.01	0.20
8	2.1	7.5	5.0	2.1	2.61	155	8.9	L.01	0.20
9 HOLMES	1.5	7.7	3.2	7.2	4.07	159	3.0	1.40	1.20
10 BROOK	1.5	7.7	3.2	7.1	4.13	159	3.0	1.30	1.30
11	2.2	7.8	5.0	7.8	4.32	228	1.8	0.60	0.89
12	2.2	7.8	5.0	7.6	4.32	227	2.1	0.63	0.90
13	2.2	7.9	4.8	7.8	4.32	225	2.1	0.66	0.96
14	1.9	7.8	4.7	7.8	4.15	234	2.8	1.30	1.20
15 MONQUART	1.0	7.5	1.3	4.7	4.24	74	3.0	0.53	0.57
16 STREAM	1.5	7.8	2.0	6.1	4.49	140	1.3	0.50	0.73
17	1.4	7.6	2.0	6.0	4.49	151	2.0	0.59	0.66
18 LOWER	1.5	8.1	4.0	8.6	3.57	251	3.7	1.70	1.50
19 GUISIQUIT	1.8	7.8	3.4	7.5	3.64	216	3.8	0.57	0.89
20	1.7	7.7	3.6	7.7	4.32	243	4.1	1.00	0.92

TABLE 7: MAJOR ION AND PHYSICAL PARAMETER OBSERVATIONS,
1986 N.B. PESTICIDE SURVEY. REPORTED IN MG/L, UNLESS OTHERWISE NOTED

		PHOSPHORUS TOTAL	RESIDUE NON FILT.
1	PRESQUE	0.008	L10.
2	ISLE	0.025	L10.
3		0.015	
4		0.016	
5		0.016	L10.
6	MOOSE MTN.	0.008	L10.
7	LAKE	0.012	L10.
8		0.012	L10.
9	HOLMES	0.020	L10.
10	BROOK	0.021	
11		0.019	L10.
12		0.017	L10.
13		0.020	L10.
14		0.017	L10.
15	MONQUART	0.005	L10.
16	STREAM	0.013	L10.
17		0.011	L10.
18	LOWER	0.013	L10.
19	GUISIGUIT	0.026	L10.
20		0.035	L10.

TABLE 8: METAL OBSERVATIONS FOR 1986 N.B. PESTICIDE SURVEY, REPORTED IN MG/L

	STN	SAMPLE	SDATE	COPPER EXTRACTABLE	LEAD EXTRACTABLE	ZINC EXTRACTABLE	IRON EXTRACTABLE	MANGANESE EXTRACTABLE
1	PRESQUE	00NB01AJ0032	600372	30-APR-86	L.002	L.002	L.01	0.07	0.01
2	ISLE	00NB01AJ0032	601203	04-JUL-86	L.002	L.002	L.01	0.12	0.06
3		00NB01AJ0032	601470	05-AUG-86	L.002	L.002	L.01	0.15	0.03
4		00NB01AJ0032	601471	05-AUG-86	L.002	L.002	L.01	0.00	0.03
5		00NB01AJ0032	601469	05-AUG-86	L.002	L.002	L.01	0.14	0.04
6	MOOSE MTN.	01NB01AJ0005	600369	29-APR-86	L.002	L.002	L.01	0.05	L.01
7	LAKE	01NB01AJ0005	601201	03-JUL-86	L.002	L.002	L.01	0.10	0.03
8		01NB01AJ0005	601474	06-AUG-86	L.002	L.002	L.01	0.16	0.02
9	HOLMES	01NB01AJ0006	600368	29-APR-86	L.002	L.002	L.01	0.12	0.04
10	BROOK	01NB01AJ0006	600366	29-APR-86	L.002	L.002	L.01	0.12	0.03
11		01NB01AJ0006	600367	29-APR-86	L.002	L.002	L.01	0.14	0.03
12		01NB01AJ0006	601198	03-JUL-86	L.002	L.002	L.01	0.24	0.08
13		01NB01AJ0006	601199	03-JUL-86	L.002	L.002	L.01	0.24	0.08
14		01NB01AJ0006	601200	03-JUL-86	L.002	L.002	L.01	0.22	0.08
15		01NB01AJ0006	601475	06-AUG-86	L.002	L.002	L.01	0.29	0.07
16	MONQUART	01NB01AJ0007	600370	30-APR-86	L.002	L.002	L.01	0.47	L.01
17	STREAM	01NB01AJ0007	601202	03-JUL-86	L.002	L.002	L.01	0.05	0.03
18		01NB01AJ0007	601473	06-AUG-86	L.002	L.002	L.01	0.03	0.01
19	LOWER	01NB01AJ0008	600371	30-APR-86	L.002	L.002	L.01	0.11	L.01
20	GUISIGUIT	01NB01AJ0008	601197	02-JUL-86	L.002	L.002	L.01	0.06	0.07
21		01NB01AJ0008	601472	06-AUG-86	L.002	L.002	L.01	0.05	0.02

		ALUMINUM EXTRACTABLE	CADMIUM EXTRACTABLE
1	PRESQUE	0.023	L.001
2	ISLE	0.080	L.001
3		0.030	L.001
4		0.022	L.001
5		0.030	L.001
6	MOOSE MTN.	L.010	L.001
7	LAKE	0.010	L.001
8		L.010	L.001
9	HOLMES	0.090	L.001
10	BROOK	0.090	L.001
11		0.093	L.001
12		0.050	L.001
13		0.060	L.001
14		0.080	L.001
15		0.032	L.001
16	MONQUART	0.040	L.001
17	STREAM	0.040	L.001
18		0.025	L.001
19	LOWER	0.052	L.001
20	GUISIGUIT	0.050	L.001
21		0.013	L.001

TABLE 9: PESTICIDES AND ENVIRONMENTAL CONTAMINANT OBSERVATIONS IN WATER, 1986 N.B. PESTICIDE SURVEY. REPORTED IN UG/L.

	STN	SAMPLE	SDATE	P,P-DDT	O,P-DDT	P,P'-DDD	P,P-DDE	P,P-METHOXY CHLOR	HEPTACHLOR
1	FRESQUE	00NB01AJ0032	600379	30-APR-86	L.001	L.001	L.001	L.001	L.01	L.001
2	ISLE	00NB01AJ0032	601196	04-JUL-86	L.001	L.001	L.001	L.001	L.01	L.001
3		00NB01AJ0032	601479	05-AUG-86	L.001	L.001	L.001	L.001	L.01	L.001
4		00NB01AJ0032	601480	05-AUG-86	L.001	L.001	L.001	L.001	L.01	L.001
5		00NB01AJ0032	601481	05-AUG-86	L.001	L.001	L.001	L.001	L.01	L.001
6		00NB01AJ0032	601486	05-AUG-86	L.001	L.001	L.001	L.001	L.01	L.001
7	MOOSE MTN.	01NB01AJ0005	600376	29-APR-86	L.001	L.001	L.001	L.001	L.01	L.001
8	LAKE	01NB01AJ0005	601194	03-JUL-86	L.001	L.001	L.001	L.001	L.01	L.001
9		01NB01AJ0005	601484	06-AUG-86	L.001	L.001	L.001	L.001	L.01	L.001
10	HOLMES	01NB01AJ0006	600373	29-APR-86	L.001	L.001	L.001	L.001	L.01	L.001
11	BROOK	01NB01AJ0006	600374	29-APR-86	L.001	L.001	L.001	L.001	L.01	L.001
12		01NB01AJ0006	600375	29-APR-86	L.001	L.001	L.001	L.001	L.01	L.001
13		01NB01AJ0006	601187	03-JUL-86	L.001	L.001	L.001	L.001	L.01	L.001
14		01NB01AJ0006	601188	03-JUL-86	L.001	L.001	L.001	L.001	L.01	L.001
15		01NB01AJ0006	601189	03-JUL-86	L.001	L.001	L.001	L.001	L.01	L.001
16		01NB01AJ0006	601193	03-JUL-86	L.001	L.001	L.001	L.001	L.01	L.001
17		01NB01AJ0006	601485	06-AUG-86	L.001	L.001	L.001	L.001	L.01	L.001
18	MONQUART	01NB01AJ0007	600377	30-APR-86	L.001	L.001	L.001	L.001	L.01	L.001
19	STREAM	01NB01AJ0007	601195	03-JUL-86	L.001	L.001	L.001	L.001	L.01	L.001
20		01NB01AJ0007	601483	06-AUG-86	L.001	L.001	L.001	L.001	L.01	L.001
21	LOWER	01NB01AJ0008	600378	30-APR-86	L.001	L.001	L.001	L.001	L.01	L.001
22	GUISIQUIT	01NB01AJ0008	601186	02-JUL-86	L.001	L.001	L.001	L.001	L.01	L.001
23		01NB01AJ0008	601482	06-AUG-86	L.001	L.001	L.001	L.001	L.01	L.001

		HEPTACHLOR EPOXIDE	ALPHA ENDO-SULPHAN	BETA ENDO-SULPHAN	ALPHA CHLORDANE	GAMMA CHLORDANE	GAMMA BHC	ALPHA BHC	MIREX	ALDRIN
1	FRESQUE	L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
2	ISLE	L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
3		L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
4		L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
5		L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
6		L.001	L.01	L.01	L.005	L.005	L.001	0.001	L.001	L.001
7	MOOSE MTN.	L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
8	LAKE	L.001	L.01	L.01	L.005	L.005	L.001	0.002	L.001	L.001
9		L.001	L.01	L.01	L.005	L.005	L.001	0.001	L.001	L.001
10	HOLMES	L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
11	BROOK	L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
12		L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
13		L.001	L.01	L.01	L.005	L.005	L.001	0.001	L.001	L.001
14		L.001	L.01	L.01	L.005	L.005	L.001	0.001	L.001	L.001
15		L.001	L.01	L.01	L.005	L.005	L.001	0.001	L.001	L.001
16		L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
17		L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
18	MONQUART	L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
19	STREAM	L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
20		L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
21	LOWER	L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
22	GUISIQUIT	L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001
23		L.001	L.01	L.01	L.005	L.005	L.001	L.001	L.001	L.001

TABLE 9: PESTICIDES AND ENVIRONMENTAL CONTAMINANT OBSERVATIONS IN WATER, 1986 N.B. PESTICIDE SURVEY. REPORTED IN UG/L.

	ENDRIN	DIELDRIN	AROCHLOR TOTAL	DIAZINON	DISYSTON	MALATHION	PHORATE	IMIDAN	CARBOFURAN	ALDICARB SULFONE
1 PRESQUE	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
2 ISLE	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
3	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
4	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
5	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
6	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
7 MOOSE MTN.	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
8 LAKE	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
9	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
10 HOLMES	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
11 BROOK	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
12	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
13	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
14	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
15	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
16	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
17	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
18 MONQUART	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
19 STREAM	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
20	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
21 LOWER	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
22 GUISIGUIT	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01
23	L.01	L.001	L.005	L.001	L.001	L.001	L.001	L.004	L.01	L.01

	ALDICARB SULFOXIDE	ALDICARB	2,4-D	MCPA	ATRAZINE	METRIBUZIN	SIMIZINE	ALACHLOR	EPTC	LINURON
1 PRESQUE	L.01	L.01	L.004	L.10	L.004	L.03	L.02	L.015	L.002	L.008
2 ISLE	L.01	L.01	L.004	L.1	L.004	L.008	L.004	L.015	L.002	0.031
3	L.01	L.01	L.004	L.10	L.004	L.008	L.004	L.015	L.002	L.008
4	L.01	L.01	L.004	L.10	L.004	L.008	L.004	L.015	L.002	L.008
5	L.01	L.01	L.004	L.10	L.004	L.008	L.004	L.015	L.002	L.008
6	L.01	L.01	L.004	L.10	L.004	L.008	L.004	L.015	L.002	L.008
7 MOOSE MTN.	L.01	L.01	L.004	L.10	L.004	L.03	L.02	L.015	L.002	L.008
8 LAKE	L.01	L.01	L.004	L.1	L.004	L.008	L.004	L.015	L.002	L.008
9	L.01	L.01	L.004	L.10	L.004	L.008	L.004	L.015	L.002	L.008
10 HOLMES	L.01	L.01	L.004	L.10	L.004	L.03	L.02	L.015	L.002	L.008
11 BROOK	L.01	L.01	L.004	L.10	L.004	L.03	L.02	L.015	L.002	L.008
12	L.01	L.01	L.004	L.10	L.004	L.03	L.02	L.015	L.002	L.008
13	L.01	L.01	L.004	L.1	L.004	L.008	L.004	L.015	L.002	L.008
14	L.01	L.01	L.004	L.1	L.004	L.008	L.004	L.015	L.002	L.008
15	L.01	L.01	L.004	L.1	L.004	L.008	L.004	L.015	L.002	L.008
16	L.01	L.01	L.004	L.1	L.004	L.008	L.004	L.015	L.002	L.008
17	L.01	L.01	L.004	L.10	L.004	L.008	L.004	L.015	L.002	L.008
18 MONQUART	L.01	L.01	L.004	L.10	L.004	L.03	L.02	L.015	L.002	L.008
19 STREAM	L.01	L.01	L.004	L.1	L.004	L.008	L.004	L.015	L.002	L.008
20	L.01	L.01	L.004	L.10	L.004	L.008	L.004	L.015	L.002	L.008
21 LOWER	L.01	L.01	L.004	L.10	L.004	L.03	L.02	L.015	IN	L.008
22 GUISIGUIT	L.01	L.01	L.004	L.1	L.004	L.008	L.004	L.015	L.002	L.008
23	L.01	L.01	L.004	L.10	L.004	L.008	L.004	L.015	L.002	L.008

TABLE 9: PESTICIDES AND ENVIRONMENTAL CONTAMINANT OBSERVATIONS IN WATER, 1986 N.B. PESTICIDE SURVEY. REPORTED IN UG/L.

		CHLORO-THALONIL	CARBARYL	DINOSEB
1	PRESQUE	L.008	L.01	L.02
2	ISLE	L.008	L.01	L.02
3		L.008	L.01	L.02
4		L.008	L.01	L.02
5		L.008	L.01	L.02
6		L.008	L.01	L.02
7	MOOSE MTN.	L.008	L.01	L.02
8	LAKE	L.007	L.01	L.02
9		L.007	L.01	L.02
10	HOLMES	L.007	L.01	L.02
11	BROOK	L.008	L.01	L.02
12		L.008	L.01	L.02
13		L.008	L.01	L.02
14		L.008	L.01	L.02
15		L.007	L.01	L.02
16		L.007	L.01	L.02
17		L.007	L.01	L.02
18	MONQUART	L.008	L.01	L.02
19	STREAM	L.001	L.01	L.02
20		L.007	L.01	L.02
21	LOWER	L.008	L.01	L.02
22	GUISIGUIT	L.007	L.01	L.02
23		L.007	L.01	L.02

TABLE 10: PESTICIDES AND ENVIRONMENTAL CONTAMINANT OBSERVATIONS IN BOTTOM SEDIMENT
1986 N.B. PESTICIDE SURVEY. REPORTED IN MG/KG

	STN	SAMPLE	SDATE	PP-DDT	OP-DDT	PP-DDD	PP-DDE	PP-METHOXY	HEPTACH	HEP.EPOX
1	MOOSE MTN.	51NB01AJ0005	601213	03-JUL-86	0.026	L0.001	0.053	0.027	L0.05	L0.001	L0.001
2	LAKE	51NB01AJ0005	601214	03-JUL-86	*0*IN**	L0.001	0.040	0.017	L0.05	L0.001	L0.001
3		51NB01AJ0005	601215	03-JUL-86	L0.001	L0.001	0.042	0.022	L0.05	L0.001	L0.001
4		51NB01AJ0005	601502	06-AUG-86	0.004	L0.001	0.030	0.018	L0.05	L0.001	L0.001
5		51NB01AJ0005	601503	06-AUG-86	0.004	L0.001	0.027	0.016	L0.05	L0.001	L0.001
6		51NB01AJ0005	601504	06-AUG-86	0.004	L0.001	0.028	0.017	L0.05	L0.001	L0.001
7	HOLMES	51NB01AJ0006	601209	03-JUL-86	0.510	0.051	0.060	0.130	L0.05	L0.001	L0.001
8	BROOK	51NB01AJ0006	601210	03-JUL-86	0.270	0.050	0.100	0.140	L0.05	L0.001	L0.001
9		51NB01AJ0006	601211	03-JUL-86	0.260	0.042	0.093	0.140	L0.05	L0.001	L0.001
10		51NB01AJ0006	601506	06-AUG-86	0.220	0.029	0.065	0.110	L0.05	L0.001	L0.001
11		51NB01AJ0006	601507	06-AUG-86	0.170	0.028	0.067	0.110	L0.05	L0.001	L0.001
12		51NB01AJ0006	601508	06-AUG-86	0.190	0.030	0.068	0.110	L0.05	L0.001	L0.001
13	MONQUART	51NB01AJ0007	601217	03-JUL-86	0.051	0.008	0.033	0.051	L0.05	L0.001	L0.001
14	STREAM	51NB01AJ0007	601218	03-JUL-86	0.053	0.008	0.033	0.050	L0.05	L0.001	L0.001
15		51NB01AJ0007	601219	03-JUL-86	0.110	0.009	0.035	0.054	L0.05	L0.001	L0.001
16		51NB01AJ0007	601499	06-AUG-86	0.028	0.006	0.014	0.026	L0.05	L0.001	L0.001
17		51NB01AJ0007	601500	06-AUG-86	0.028	0.006	0.016	0.028	L0.05	L0.001	L0.001
18		51NB01AJ0007	601498	12-AUG-86	0.037	0.006	0.014	0.028	L0.05	L0.001	L0.001
19	LOWER	51NB01AJ0008	601206	02-JUL-86	0.025	0.007	0.009	0.028	L0.05	L0.001	L0.001
20	GUISIGUIT	51NB01AJ0008	601207	02-JUL-86	0.024	0.006	0.009	0.023	L0.05	L0.001	L0.001
21		51NB01AJ0008	601205	02-JUL-86	0.028	0.006	0.007	0.024	L0.05	L0.001	L0.001
22		51NB01AJ0008	601494	06-AUG-86	0.014	0.005	0.007	0.024	L0.05	L0.001	L0.001
23		51NB01AJ0008	601495	06-AUG-86	0.013	0.004	0.007	0.023	L0.05	L0.001	L0.001
24		51NB01AJ0008	601496	06-AUG-86	0.013	0.004	0.007	0.025	L0.05	L0.001	L0.001
25	PRESQUE	51NB01AJ0032	601490	05-AUG-86	0.014	L0.001	0.010	0.019	L0.05	L0.001	L0.001
26	ISLE	51NB01AJ0032	601491	05-AUG-86	0.008	0.002	0.011	0.016	L0.05	L0.001	L0.001
27		51NB01AJ0032	601492	05-AUG-86	0.009	0.003	0.011	0.017	L0.05	L0.001	L0.001

TABLE 10: PESTICIDES AND ENVIRONMENTAL CONTAMINANT OBSERVATIONS IN BOTTOM SEDIMENT
1986 N.B. PESTICIDE SURVEY. REPORTED IN MG/KG

		A-ENDO	B-ENDO	A-CHLOR	G-CHLOR	LINDANE	A-BHC	MIREX	ALDRIN	ENDRIN	TOT.PCB	DIAZINON
1	MOOSE MTN.	L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.020
2	LAKE	L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.021
3		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.022
4		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.023
5		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.022
6		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.022
7	HOLMES	L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.007
8	BROOK	L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.007
9		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.007
10		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.008
11		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.008
12		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.008
13	MONQUART	L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.010
14	STREAM	L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.010
15		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.011
16		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.008
17		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.008
18		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.008
19	LOWER	L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.007
20	GUISIGUIT	L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.008
21		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.007
22		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.007
23		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.007
24		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.007
25	FRESQUE	L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.010
26	ISLE	L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.011
27		L0.01	L0.01	L0.005	L0.005	L0.001	L0.001	L0.001	L0.001	L0.01	L0.005	L0.010

TABLE 10: PESTICIDES AND ENVIRONMENTAL CONTAMINANT OBSERVATIONS IN BOTTOM SEDIMENT
1986 N.B. PESTICIDE SURVEY. REPORTED IN MG/KG

		DISYSTON	MALATHION	PHORATE	CARBOFUR	2,4-D	MCPA	ATRAZINE	METBZINE	SIMIZINE	ALACHLOR
1	MOOSE MTN.	L0.020	L0.024	L0.013	L0.01	L0.004	L0.1	L0.025	L0.040	L0.025	L0.021
2	LAKE	L0.021	L0.025	L0.014	L0.01	L0.004	L0.1	L0.026	L0.042	L0.026	L0.022
3		L0.022	L0.027	L0.015	L0.01	L0.004	L0.1	L0.028	L0.044	L0.028	L0.024
4		L0.023	L0.028	L0.015	L0.01	L0.004	L0.1	L0.029	L0.046	L0.029	L0.025
5		L0.022	L0.028	L0.015	L0.01	L0.004	L0.1	L0.027	L0.043	L0.027	L0.025
6		L0.022	L0.028	L0.015	L0.01	L0.004	L0.1	L0.028	L0.045	L0.028	L0.025
7	HOLMES	L0.007	L0.008	L0.005	L0.01	L0.004	L0.1	L0.009	L0.014	L0.009	L0.007
8	BROOK	L0.007	L0.008	L0.005	L0.01	L0.004	L0.1	L0.009	L0.015	L0.009	L0.008
9		L0.007	L0.008	L0.005	L0.01	L0.004	L0.1	L0.009	L0.014	L0.009	L0.007
10		L0.008	L0.009	L0.005	L0.01	L0.004	L0.1	L0.010	L0.016	L0.010	L0.008
11		L0.008	L0.009	L0.005	L0.01	L0.004	L0.1	L0.010	L0.015	L0.010	L0.008
12		L0.008	L0.009	L0.005	L0.01	L0.004	L0.1	L0.010	L0.015	L0.010	L0.008
13	MONCUART	L0.010	L0.013	L0.007	L0.01	L0.004	L0.1	L0.013	L0.021	L0.013	L0.011
14	STREAM	L0.010	L0.013	L0.007	L0.01	L0.004	L0.1	L0.013	L0.021	L0.013	L0.011
15		L0.011	L0.013	L0.007	L0.01	L0.004	L0.1	L0.009	L0.021	L0.009	L0.011
16		L0.008	L0.009	L0.005	L0.01	L0.004	L0.1	L0.009	L0.015	L0.009	L0.008
17		L0.008	L0.009	L0.005	L0.01	L0.004	L0.1	L0.009	L0.015	L0.009	L0.008
18		L0.010	**0*IN**	L0.005	L0.01	L0.004	L0.1	L0.010	L0.016	L0.010	L0.008
19	LOWER	L0.007	L0.009	L0.005	L0.01	L0.004	L0.1	L0.009	L0.015	L0.009	L0.008
20	SUISIQUIT	L0.008	L0.009	L0.005	L0.01	L0.004	L0.1	L0.009	L0.015	L0.009	L0.008
21		L0.007	L0.009	L0.005	L0.01	L0.004	L0.1	L0.009	L0.015	L0.009	L0.008
22		L0.007	L0.009	L0.005	L0.01	L0.004	L0.1	L0.009	L0.015	L0.009	L0.008
23		L0.007	L0.009	L0.005	L0.01	L0.004	L0.1	L0.009	L0.015	L0.009	L0.008
24		L0.007	L0.009	L0.005	L0.01	L0.004	L0.1	L0.009	L0.015	L0.009	L0.008
25	PRESQUE	L0.010	L0.012	L0.007	L0.01	L0.004	L0.1	L0.013	L0.020	L0.013	L0.011
26	ISLE	L0.011	L0.013	L0.007	L0.01	L0.004	L0.1	L0.014	L0.022	L0.014	L0.012
27		L0.010	L0.012	L0.007	L0.01	L0.004	L0.1	L0.125	L0.020	L0.014	L0.011

TABLE 11: DDT SUBSTRATES AND RATIOS IN SEDIMENTS FROM 1986 N.B. PESTICIDE SURVEY

		SDATE	PP-DDT	OP-DDT	PP-DDD	PP-DDE	TOTAL DDT SUBSTRATES	DDE/DDD RATIO	SUM PARENT DDT	SUM METABOLITES	PAR./MET. RATIO
1	MOOSE MTN.	03-JUL-86	0.026	L.001	0.053	0.027	0.106	0.509434	0.026	0.080	0.325000
2	LAKE	03-JUL-86	L.001	L.001	0.040	0.017	0.057	0.425000	0.000	0.057	0.000000
3		03-JUL-86	L.001	L.001	0.042	0.022	0.064	0.523810	0.000	0.064	0.000000
4		06-AUG-86	0.004	L.001	0.030	0.018	0.052	0.600000	0.004	0.048	0.083333
5		06-AUG-86	0.004	L.001	0.027	0.016	0.047	0.592593	0.004	0.043	0.093023
6		06-AUG-86	0.004	L.001	0.028	0.017	0.049	0.607143	0.004	0.045	0.088889
7	HOLMES	03-JUL-86	0.510	0.051	0.060	0.130	0.751	2.166667	0.561	0.190	2.952632
8	BROOK	03-JUL-86	0.270	0.050	0.100	0.140	0.560	1.400000	0.320	0.240	1.333333
9		03-JUL-86	0.260	0.042	0.093	0.140	0.535	1.505376	0.302	0.233	1.296137
10		06-AUG-86	0.220	0.029	0.065	0.110	0.424	1.692308	0.249	0.175	1.422857
11		06-AUG-86	0.170	0.028	0.067	0.110	0.375	1.641791	0.198	0.177	1.118644
12		06-AUG-86	0.190	0.030	0.068	0.110	0.398	1.617647	0.220	0.178	1.235955
13	MONOUART	03-JUL-86	0.051	0.008	0.033	0.051	0.143	1.545455	0.059	0.084	0.702381
14	STREAM	03-JUL-86	0.053	0.008	0.033	0.050	0.144	1.515152	0.061	0.083	0.734940
15		03-JUL-86	0.110	0.009	0.035	0.054	0.208	1.542857	0.119	0.089	1.337079
16		06-AUG-86	0.028	0.006	0.014	0.026	0.074	1.857143	0.034	0.040	0.850000
17		06-AUG-86	0.028	0.006	0.016	0.028	0.078	1.750000	0.034	0.044	0.772727
18		12-AUG-86	0.037	0.006	0.014	0.028	0.085	2.000000	0.043	0.042	1.023810
19	LOWER	02-JUL-86	0.025	0.007	0.009	0.028	0.069	3.111111	0.032	0.037	0.864865
20	GUISIGUIT	02-JUL-86	0.024	0.006	0.009	0.023	0.062	2.555556	0.030	0.032	0.937500
21		02-JUL-86	0.028	0.006	0.007	0.024	0.065	3.428571	0.034	0.031	1.096774
22		06-AUG-86	0.014	0.005	0.007	0.024	0.050	3.428571	0.019	0.031	0.612903
23		06-AUG-86	0.013	0.004	0.007	0.023	0.047	3.285714	0.017	0.030	0.566667
24		06-AUG-86	0.013	0.004	0.007	0.025	0.049	3.571429	0.017	0.032	0.531250
25	PRESQUE	05-AUG-86	0.014	L.001	0.010	0.019	0.043	1.900000	0.014	0.029	0.482759
26	ISLE	05-AUG-86	0.008	0.002	0.011	0.016	0.037	1.454545	0.010	0.027	0.370370
27		05-AUG-86	0.009	0.003	0.011	0.017	0.040	1.545455	0.012	0.028	0.428571

TABLE 12: QUALITY CONTROL OBSERVATIONS, 1896 N.B. PESTICIDE SURVEY
REPORTED IN PERCENT RECOVERY

	STN	SAMPLE	SDATE	P,P-DDT	O,P-DDT	P,P'-DDE	P,P-METHOXY CHLOR	HEPTACHLOR	ALPHA ENDO-SULPHAN
1	00NB01AJFS32	600380	30-APR-86						
2	00NB01AJFS32	600381	30-APR-86						
3									
4	01NB01AJFSDW	601190	03-JUL-86	108	92	83	110	65	72
5	01NB01AJFS06	601191	03-JUL-86	112	87	87	130	77	96
6	01NB01AJFS06	601192	03-JUL-86	111	90	86	116	70	53
7									
8	00NB01AJFSDW	601487	05-AUG-86	98	98	80	108	80	80
9	00NB01AJFS32	601488	05-AUG-86	80	80	71	91	62	59
10	00NB01AJFS32	601489	05-AUG-86	70	71	57	78	57	53
11									
12									
13	MEAN			97	86	77	106	69	69

	BETA ENDO-SULPHAN	ALPHA CHLORDANE	GAMMA CHLORDANE	GAMMA BHC	ALPHA BHC	MIREX	DIAZINON	DISYSTON	MALATHION	PHORATE	CARBOFURAN
1											
2											
3											
4	69	43	65	74	93	71	111	19	157	111	102
5	53	53	67	77	86	70	115	96	115	144	48
6	48	43	66	76	86	73	95	84	66	76	95
7											
8	67	48	80	89	115	74	133	0	115	0	80
9	53	48	62	63	71	56	80	44	89	71	80
10	48	43	57	48	66	54	57	48	50	76	86
11											
12											
13	56	46	66	71	86	66	99	49	99	80	82

	2,4-D	METRIBUZIN	SIMIZINE	CARBARYL	ALACHLOR	DINOSEB	EPTC	LINURON	CHLORO THALONIL
1					140	44	63	100	147
2					102	55	0	82	123
3									
4	100	74	48	93		125		51	38
5	100	80	50	86		150		77	38
6	144	76	49	86		100		71	38
7									
8	100	100	40	60		94		66	71
9	60	120	44	70		100		44	38
10	74	114	40	76		75		57	38
11									
12									
13	96	94	45	79	121	93	32	69	66